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Docket No.: 50090-290

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Customer Number: 20277
	:	
Keiichiro WAKAMIYA, et al.	:	Confirmation Number: 2402
	:	
Application No.: 09/818,906	:	Group Art Unit: 2811
	:	
Filed: March 28, 2001	:	Examiner: Nitin Parekh
	:	
For: SEMICONDUCTOR DEVICE	:	

REPLY BRIEF

Mail Stop Reply Brief
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This Reply Brief is submitted in response to the Examiner's Answer which is dated both
September 9, 2004 and September 10, 2004.

The Claims

Appellants acknowledge the Examiner's allowance of claims 1 through 6. Accordingly, the only issue before the Honorable Board is the correctness of the Examiner's rejection of remaining claims 7 through 13, claim 7 being the only independent claim. Appellants confirm that the patentability of claims 7 through 13 stands or falls with the patentability of independent claim 7.

The Issue

The pivotal issue on Appeal is whether the Examiner committed legal error in rejecting claim 7 under 35 U.S.C. § 103¹ for obviousness predicated upon Yamaji et al. in view of Ohtsuka et al. and Chakravorty. In the Answer, the Examiner basically adhered to the position set forth in the Final Office Action of March 9, 2004. The Examiner, however, made certain inaccurate factual determinations and committed legal error in arriving at the ultimate legal conclusion of obviousness, particularly by overtly ignoring a potent indicium of nonobviousness which the Examiner never denied.

Argument

Assuming, arguendo, that the barrier metal layer 4a in the Fig. 3 embodiment of Yamaji et al. is interpreted as a connecting conductor, Appellants stress that it is a **single layer**. Moreover, the notion of providing a stress absorbing layer is conspicuous by its complete absence from the entire disclosure of Yamaji et al. So much the Examiner does **not deny**.

Neither of the secondary references discloses or suggests a conductive element penetrating the coating layer as in the claimed invention, without belaboring whether the disclosed elements are

¹ The actual rejection is of claims 7 and 8 under 35 U.S.C. § 103.

connecting conductors or function in some other capacity. Notwithstanding that conspicuous gap, the Examiner would treat these secondary references as teaching references.

In the ultimate paragraph on page 6 of the Answer, the Examiner concluded that one having ordinary skill in the art would have been motivated to incorporate the plurality of layers of the connecting conductors formed of different metals as taught by Chakravorty. But why? The mere fact that Chakravorty incidentally discloses the use of plural layers does automatically mean that one having ordinary skill in the art would somehow be realistically impelled to restructure the device disclosed by the primary reference to Yamaji et al. and form plural barrier metal layers 4. This approach falls far short of the judicial requirements for making clear and particular factual findings as to a specific understanding or a specific technological principal which would have realistically impelled one having ordinary skill in the art to modify the device of Yamaji et al. by forming plural barrier metal layers 4. *In re Lee*, 237 F.3d 1338, 61 USPQ2d 1430 (Fed. Cir. 2002); *Ecolchem Inc. v. Southern California Edison, Co.* 227 F.3d 1361, 56 USPQ2d 1065 (Fed. Cir. 2000); *In re Kotzab*, 217 F.3d 1365, 55 USPQ 1313 (Fed. Cir. 2000); *In re Dembiczak*, 175 F.3d 994, 50 USPQ2d 1614 (Fed. Cir. 1999). What the Examiner has actually done is simply identify wherein a feature of the claimed invention may or may not exist in a secondary reference and then announce the motivational element. This approach is legally erroneous. *In re Kotzab, supra*; *Smith Kline Diagnostics, Inc. v. Helena Laboratories Corp.*, 859 F.2d 878, 8 USPQ2d 1468 (Fed. Cir. 1988).

Further, the Examiner's interpretation of Chakravorty does not appear accurate. Specifically, in the paragraph bridging pages 5 and 6 of the Answer, the Examiner notes that element 321 in Figs. 10b-10g may comprise layers of chromium and copper. Layer 321 is an under bump metal layer which basically corresponds to under bump metal layer 310 shown in Figs. 4 and

5. As disclosed at column 9 of Chakravorty, lines 24 et seq., if the metal bumps are electroplated (not electrolessly plated) then:

... UBM (under bump metal) layer 310 **could** be configured from a combination of Cr and Cu layers. The Cr layer functions as an adhesion or glue layer whereas the Cu layer provides an electrolytical or electroless plating seed layer for a soldered material. (emphasis supplied).

The Examiner made **no** factual determination as to whether an electrolytic or electroless plating **seed layer** has the requisite structural integrity to function as a stress absorbing layer, because he apparently cannot. In fact, the Examiner does not state that the seed layer for a soldered material functions as a stress absorbing layer. **The Examiner simply broadly construes the adhesion layer and seed layer as a composite so that he can jump into Ohtsuka et al. and somehow dig out a stress absorbing layer to replace the seed layer.**

The Examiner also states that layer 325 can be formed of a metallic material the same as the UBM layers. The Examiner refers to column 13 of Chakravorty, line 25 to column 14, line 35. Layer 325 results from depositing layer 322 (Fig. 10c) which is reflowed into bump 323 (Fig. 10d) and then polished to form element 325. But element 322, the precursor for element 325 mentioned by the Examiner, is formed of a solder, such as Pb/Sn so that it can be reflowed. The Examiner, in the ultimate sentence in the paragraph bridging pages 5 and 6 of the Answer, states that this layer is equivalent to the UBM layers. It is **not**. The UBM layers comprise an adhesion layer of Cr and a seed layer of Cu thereon; whereas, the bump layers comprise a solder such as Pb/Sn which can be reflowed.

The distinction between the element 321 and 325 is not insignificant because element 321 does not protrude through a protective layer.

After focusing on the under bump metal layer of Chakravorty, comprising an adhesion layer of Cr and a solder layer of Cu thereon, formed within and not penetrating the protective layer, the Examiner turns to Ohtsuka et al. In applying Ohtsuka et al. the Examiner committed further error.

Specifically, the Examiner identifies layer 38 in Figs. 5b, 5c of Ohtsuka et al. as a gold stress absorbing layer (first full paragraph on page 6 of the Answer). **But gold layer 38 does not exist in the semiconductor device disclosed by Ohtsuka et al.** The Examiner appears to have overlooked the fact that gold layer 38 is flash plated (column 5 of Ohtsuka et al., line 60) and is subsequently alloyed with protruding contact 37 to form a diffusion barrier alloy layer of gold and indium identified by reference numeral 36.

It is, therefore, clear that the barrier layer is only a single layer 35 of nickel. On barrier layer 35 is an additional layer, but that is not a barrier metal layer, but a diffusion barrier to prevent metal from the actual barrier layer (nickel) from diffusing therethrough. This structure of nickel with a copper-indium alloy bears **no** resemblance to the Cr/Cu layers in the device of Chakravorty.

Claim 7 requires the plurality of connecting conductors which are connected to the semiconductor chip to penetrate the coating layer beyond the outside surface thereof.

On Appeal, Appellants argued that neither of the secondary references disclose the concept of a connecting conductor comprising a plurality of layers, which connecting conductor penetrates the coating layer beyond the outside surface thereof. Appellants recognize that the primary reference discloses what may be considered a connecting conductor penetrating the coating layer. But that is a **single** layer. There is no suggestion in Yamaji et al. for a stress absorbing layer. Since the Examiner has turned to the secondary references to modify what he considers to be the connecting conductors of Yamaji et al. (4a), then the Examiner should follow through with the

complete teaching of the secondary references which is clear: What the Examiner calls connecting conductors in the secondary teaching references are formed entirely within and do **not** penetrate through the coating layer.

On Appeal Appellants strenuously argued that the secondary reference to Ohtsuka et al. clearly **teaches away** from the claimed invention by requiring the diffusion barrier layers to be either thinner than the protection layer 34 or preferably identical in thickness. In this respect Appellants refer to column 5 of Ohtsuka et al. second and third full paragraphs.

Thus, if the Examiner is relying upon the teachings of Ohtsuka et al. to modify layer 4 of the device disclosed by Yamaji et al., then the Examiner ought to follow the teachings of Ohtsuka et al. and form the layer 35/36 so that it is entirely within the protection layer 34 so that it can perform its function when being bonded to layer 37. In this case the claimed invention would **not** result.

Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 5 USPQ2d 1434 (Fed. Cir. 1988).

Appellants submit there is no substantial evidence of record to support the conclusion that one having ordinary skill in the art would have been motivated to replace Chakravorty's Cu **seed layer** with the **diffusion** barrier layer 36 of Chakravorty, because they are different materials that perform different functions.

Appellants, therefore, submit that a *prima facie* basis to deny patentability to the claimed invention has **not** been established. Further, Appellants again stress that the clear **teaching away** from forming a conductive layer protruding from the protective layer by Ohtsuka et al. constitutes evidence of **nonobviousness**.

The Examiner's position on the evidence of nonobviousness.

Significantly, under Item "C." commencing at page 10 of the Answer, the Examiner acknowledges Appellants' argument that Ohtsuka et al. **teach away** from the claimed invention by forming the diffusion barrier layers within the protective layer 34 illustrated in Fig. 3. It should be noted that there are no diffusion **barriers** as asserted by the Examiner, only a single diffusion barrier 36. Element 35 is a barrier layer, not a diffusion barrier layer. If element 35 was a diffusion barrier layer, there would be no need to form diffusion barrier layer 36.

At any rate, it is significant that on this record that the Examiner:

1) **does not deny** that Ohtsuka et al. **teach away** from forming the layers in question within the protective layer; and

2) **does not deny** that a teaching away from a claimed invention constitutes evidence of nonobviousness, because it does. *In re Bell*, 991 F.2d 781, 26 USPQ2d 1529 (Fed. Cir. 1993); *Specialty Composites v. Cabot Corp.*, 845 F.2d 981, 6 USPQ2d 1601 (Fed. Cir. 1988); *In re Hedges*, 783 F.2d 1038, 228 USPQ 685 (Fed. Cir. 1986) and *In re Marshall*, 578 F.2d 301, 198 USPQ 344 (CCPA 1978).

Rather than confronting the issue, the Examiner ducks by asserting that Appellants' disclosure contains an embodiment wherein the connecting conductors 4 we formed entirely within protective insulating layer 5 and 7. The Examiner then "... holds that Ohtsuka et al. do not teach away from the **invention (disclosed vis-à-vis claimed invention)** by forming the conductive conductors being protected by the insulating layer" ultimate sentence of the paragraph bridging pages 10 and 11 of the Answer.

The Examiner's approach is clearly erroneous for at least two reasons. Firstly, the protective layer in Appellants' embodiments depicted in Figs. 1 through 3 comprises elements 3 and 7, not

element 5, which is a resin. Even if Appellants had disclosed an alternative embodiment wherein the connecting conductors are entirely within a protective coating, that is irrelevant. What is relevant is that the **claimed** invention requires the connecting conductor, which includes a plurality of layers to be formed of different material, to penetrate beyond the outer surface of the coating layer. The Examiner does not deny that Ohtsuka et al. **teach away** from that that concept which is claimed, and does not deny such a teaching away in the allegedly teaching reference constitutes evidence of nonobviousness. Under such circumstances it is clear that the Examiner committed legal error in ignoring a potent indicium of **nonobviousness**.

Summary

In summary, Appellants submit the Examiner did not establish a *prima facie* basis to deny patentability to the claimed invention for lack of the requisite factual basis and lack of the requisite realistic motivation. Simply put the allegedly teaching references do not disclose and, in fact, Ohtsuka et al. teach away from, forming a connecting conductor comprising a plurality of layers which penetrates beyond the coating layer as claimed. The Examiner's attempt to mix up a seed layer with an diffusion barrier layer lacks the requisite factual basis. Moreover, the Examiner's manifest disinclination to consider the objective evidence of nonobviousness stemming from the indisputed **teaching away** from the claimed invention by the allegedly teaching reference to Ohtsuka et al. undermines the ultimate legal conclusion of obviousness under 35 U.S.C. § 103.

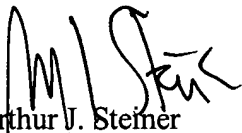
For the reasons expressed in the Appeal Brief and for the reasons expressed herein, Appellants solicit the Honorable Board to reverse the Examiner's rejection of the appealed claims under 35 U.S.C. § 103.

No.: 09/818,906

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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